

WHAT IS CLAIMED IS:

1. A vehicle antenna apparatus capable of corresponding to a plurality of radio communication systems, comprising:

5 a plurality of antennas provided correspondingly to the radio communication systems;

a plurality of processing circuits whose one ends (input ports or output ports) are connected to the antennas to apply processings including amplification and frequency conversion to signals input from the one
10 ends of the antennas received from a corresponding antenna or signals to be transmitted to a corresponding antenna input to the other ends of the antennas;

at least one external connector configured to
15 output reception signals to an external unit or inputs transmission signals sent from the external unit; and

a unit connected between the other ends of the processing circuits and the external connector to couple reception signals output from the processing
20 circuits or distribute transmission signals input from the external connector to the processing circuits.

2. A vehicle antenna apparatus capable of corresponding to a plurality of radio communication systems, comprising:

25 a plurality of receiving antennas provided correspondingly to the radio communication systems to receive radio waves transmitted from an external unit

and to output reception signals;

a plurality of receiving frequency converters
configured to frequency-convert reception signals sent
from the receiving antennas;

5 a coupler configured to couple signals output from
the receiving frequency converters and to output one
output signal; and

at least one external connector connected with
an external unit to transfer signals output from the
10 coupler to the external unit.

3. A vehicle antenna apparatus capable of
corresponding to a plurality of radio communication
systems, comprising:

a plurality of receiving antennas provided
15 correspondingly to the radio communication systems to
receive radio waves transmitted from an external unit
and to output reception signals;

a plurality of receiving frequency converters
configured to frequency-convert signals received from
20 the antennas;

a coupler configured to couple signals output from
the receiving frequency converters and to output one
output signal;

at least one external connector connected with
25 an external unit to transfer signals output from the
coupler to the external unit;

at least one transmitting frequency converter

configured to frequency-convert transmission signals
input to the external connector from an external unit;
and

at least one transmitting antenna provided
5 correspondingly to at least one radio communication
system to receive signals output from the transmitting
frequency converter and to radiate radio waves.

4. The vehicle antenna apparatus according to
claim 2, wherein the plurality of receiving frequency
10 converters convert signals received from the plurality
of receiving antennas into proximate frequencies.

5. The vehicle communication system according
to claim 3, wherein the external connector includes
one input/output terminal and moreover includes a
15 separation element inserted between the input/output
terminal, the output end of the coupler, and the input
ends of the transmitting frequency converters to
separate transmission signals from reception signals.

6. The vehicle antenna apparatus according to
20 claim 3, wherein the external connector includes
an output terminal and an input terminal, transfers
signals output from the coupler to the external unit
through the output terminal, and inputs signals
transmitted from the external unit to the input
25 terminal.

7. The vehicle antenna apparatus according to
claim 3, further comprising a distributor configured to

distribute transmission signals input to the external connector from said external unit to the transmitting frequency converters.

5 8. The vehicle antenna apparatus according to claim 3, wherein at least one of the receiving antennas and at least one of the transmitting antennas are used in common.

10 9. The vehicle antenna apparatus according to claim 2, further comprising an A/D converter configured to convert signals output from the coupler into digital signals and supplies the digital signals to the external connector.

15 10. The vehicle antenna apparatus according to claim 2, further comprising a plurality of A/D converters configured to convert signals output from the receiving frequency converters into digital signals and supply the digital signals to the coupler, wherein the coupler couples digital signals output from the A/D converters through parallel-serial conversion and
20 synthesizes them into one signal.

25 11. The vehicle antenna apparatus according to claim 3, further comprising a D/A converter configured to convert a transmission signal input from the external connector as a digital signal into an analog signal and supplies the analog signal to the transmitting frequency converters.

12. The vehicle antenna apparatus according to

claim 2, further comprising an E/O converter configured to convert a signal output from the coupler into an optical signal and supplies the optical signal to the external connector.

5 13. The vehicle antenna apparatus according to claim 2, further comprising a plurality of E/O converters which convert signals output from the receiving frequency converters into optical signals and supply them to the coupler, wherein the coupler couples
10 optical signals output from the E/O converters and synthesizes them into one optical signal.

 14. The vehicle antenna apparatus according to claim 3, further comprising an O/E converter which converts a transmission signal input from the external
15 connector as an optical signal into an electrical signal and supplies the electrical signal to the transmitting frequency converters.

 15. The vehicle antenna apparatus according to claim 1, wherein at least one of the antennas is
20 an array antenna and a beam-forming network for forming an optional antenna beam through the array antenna is included.

 16. The vehicle antenna apparatus according to claim 15, further comprising a CPU which controls the
25 beam-forming network.

 17. The vehicle antenna apparatus according to claim 1, wherein at least one of the antennas is

an array antenna, and a beam-forming network which forms an optional antenna beam through the array antenna and a CPU which controls the beam-forming network and the processing circuits are included.

5 18. The vehicle antenna apparatus according to claim 16, further comprising a memory storing the information for the above control by the CPU.

10 19. The vehicle antenna apparatus according to claim 1, wherein the antennas are provided on the same first substrate.

15 20. The vehicle antenna apparatus according to claim 1, wherein the antennas are provided on the same first substrate and the processing circuits and a unit which performs the above coupling or distribute are provided on the first substrate or a second substrate different from the first substrate.